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Pothole Fact Sheet

Why are they called potholes?

Pottery makers in l5th and l6th century England would take advantage of the ruts that wagon and coach wheels gouged into roads. Anxious for a cheap source of raw materials for making clay pots, the potters would dig into the deep ruts to reach clay deposits underneath. Teamsters driving wagons and coaches over those roads knew who and what caused these holes and referred to them as "potholes."
- Story attributed to the late trivia expert and syndicated columnist L. M. Boyd

Recognizing America's dependence on and love of the open road, broadcast journalist Dan Rather once commented, "Americans will put up with anything provided it doesn't block traffic." That truism gets tested every spring when millions of potholes open their gaping mouths and throw themselves in the paths of unsuspecting motorists across the nation.

Mobility is integral to the American way of life. Each year 240 million registered vehicles travel nearly 3 trillion miles—an increase of more than 41% between 1990 and 2007—on almost 4 million miles of streets and highways. Two-thirds of the miles traveled are on urban roads, and 88% of the person miles of travel are done in private vehicles.

Every day, trucks haul an estimated $25 billion worth of goods—weighing approximately 32 million tons. Nearly half a million school buses deliver 55% of the nation's school children 180 days a year; one or more fire department vehicles are called out every 20 seconds in the U.S.; and nearly 60 million ambulance trips occur each year.

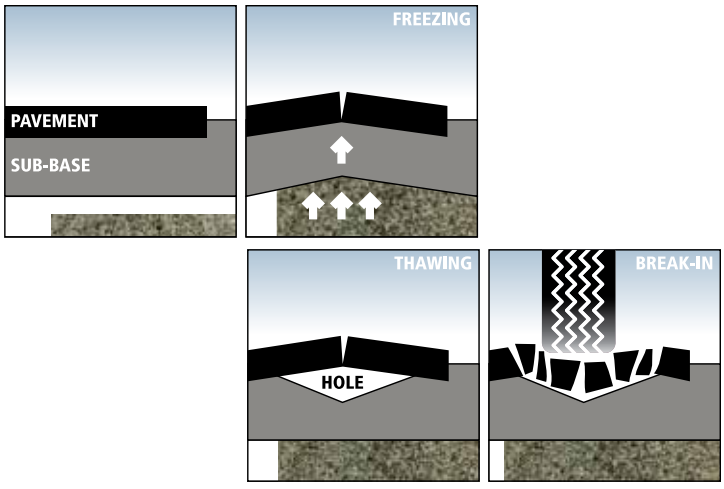
Not only do the pothole obstacle courses slow traffic, but they also extract a heavy toll on the patience and pocketbooks of motorists and municipalities alike. Driving over rough pavement affects travel costs for motorists in terms of vehicle operating costs, travel delays, and crash or accident costs. On average, motorists pay an extra $335 a year—a total of $67 million in vehicle repairs and operating costs. For municipalities, pothole repair expenses include personnel, equipment, and materials, which on a national basis is also a multi-million dollar annual expenditure. For example:

- Washington, D.C., spends approximately $900,000 each year to repair more than 220,000 potholes.
- In 2009, the City of San Diego filled 53,046 potholes, spending between $15 and $30 per patch.
- Tulsa, Oklahoma, typically pays $875,000 to make temporary repairs to as many as 20,000 – 30,000 potholes each year.
- In 2009, for just the hot and cold mix asphalt patch material, Columbus, Ohio, spent $355,390.84 to patch 114,475 potholes.

What causes a pothole?

Potholes are created when the pavement or the material beneath it—called base or subbase—cannot support the weight of the traffic it carries. Two factors are always present in such a failure: TRAFFIC and WATER. The "gestation period" for a pothole includes these milestones:

- Snow or rain seeps into cracks in the pavement and into the soil below, causing mud and eroding support as a hole forms under the pavement.
- Repeated freeze/thaw cycles or heavy traffic cause the ground to expand and push up the pavement.
- With temperature increases, the ground returns to its previous level; however, the pavement does not drop, which results in a gap between the road surface and the ground.
- Vehicles driving over the faulty pavement cause the surface to crack and fall into the hollow below the pavement, which creates the pothole.



What influences pavement life?

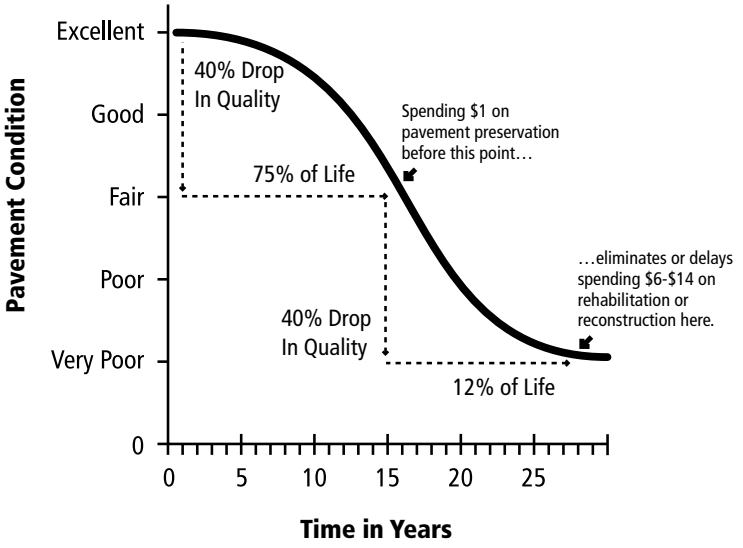
In general, pavement life is influenced by many factors: vehicle loading (axle loads, tire pressure and gross vehicle weight [GVW]), traffic volume and mix, environment, subgrade condition, initial pavement design, initial construction practices, maintenance and pavement age. Currently in the U.S., two other factors aggravate the circumstances further:

1. An estimated 30-60% of our major roadways—which are a $1.75 trillion dollar asset—are rated in poor to mediocre condition.
2. Traffic volume has increased significantly and is expected to continue increasing—but new lane-miles have not and are not expected to keep pace with the increased demand.

Although the public likes all potholes to be repaired promptly and tends to form a negative opinion of the municipality, state or other transportation agency when they aren't, the decision to patch potholes is influenced by many factors:

- Weather conditions
- The level of traffic
- The time until scheduled rehabilitation or overlay
- The availability of personnel, equipment, and materials
- The tolerance of the traveling public

According to the Federal Highway Administration's Manual of Practice for pothole repair of (FHWA-RD-99-168), "A highway agency must repair potentially hazardous potholes as soon as it becomes aware of them."



How are potholes repaired?

Pothole patching is generally performed either as an emergency repair under harsh conditions or as routine maintenance scheduled for warmer and drier periods. Depending on the materials used, patching can be performed during weather that ranges from clear spring days to harsh winter storms, with temperatures ranging from 100.4°F to -0.4°F.

Although moisture and traffic conditions vary, materials and techniques for placing quality repairs are similar for asphalt concrete (AC), which is commonly used for high-traffic roadways. The following pothole repair methods have been used successfully under actual field conditions across North America.

1. Throw-and-roll: : Patching material is placed into the pothole—which may or may not be filled with water and debris—and compacted using truck tires; a one-eighth to one-quarter inch crown on the patch is verified, and crew moves on to next pothole. (*This is considered superior to the more commonly used method of throw-and-go, which does not compact the materials before leaving the site.*)
2. Semi-permanent: Water and debris are removed from the pothole; the sides of the patch area are "squared-up" until vertical sides exist in reasonably sound pavement; mix is placed and compacted with a small, vibratory device. (*Although it raises the cost of the operation, this is considered one of the best methods for repairing potholes because it improves patch performance.*)
3. Spray-injection devices: Water and debris are blown from the pothole; a tack coat of binder is sprayed on the sides and bottom of pothole; asphalt and aggregate are blown into pothole; the patch is covered with a layer of aggregate. (*This technique has higher equipment costs, but has a higher rate of productivity and lower material costs.*)
4. Edge seal: Uses same method as throw-and-roll, but once repair section has dried, a second pass is made to place a ribbon of asphaltic tack material on top of the patch edge and pavement surfaces. A layer of sand is placed on the tack material to prevent tracking by tires, and the section is open to traffic as soon as workers and equipment are cleared from the area. (*Although this requires a second pass, it can improve patch performance in older pavements with many cracks.*)

It should be noted that using asphalt to patch potholes in concrete pavement is not as durable as patching potholes in asphalt pavement. The difference in the materials impedes the ability to form a secure bond between the pavement and the patch. The long-term solution is to make a permanent patch using concrete or a concrete-epoxy material to patch concrete pavement.

How can we stop potholes from forming?

The pavement condition, material quality, climatic influence, crew ability, and past repair performance all factor into determining the expected survival rate of a pothole patch. The success of pothole repairs depends predominantly on the timeliness of the repair and the quality of the materials and techniques used.

Stopping potholes in the all-important embryonic stage—when the pavement is cracked rather than pocked—has a significant impact on the war against potholes. However, such proactive measures are often seen as premature by agencies facing the need to do more with less in already-strained budgets. So preventive maintenance gives way to the "worst-first" mentality of deferred maintenance that concentrates on patching potholes rather than sealing cracks.

In reality, deferred maintenance starts communities on a downward spiral path of deteriorating infrastructure and increasingly costly backlogs of required repairs. Experts estimate that spending $1 on timely maintenance in the early stages of the pavement life cycle is a pavement preservation strategy that can save between $6 and $14 in rehabilitation or reconstruction costs.

Like the old adage, "A stitch in time saves nine," one and a half inches of asphalt concrete on an early-stage crack can save 20 inches of subbase and base after results of deferred maintenance have caught up with an agency.